

The End of One-Size-Fits-All Medicine?

Personalized Medicine Showing Promise

Most of the time, doctors can be pretty sure that the medicine they give you is going to help. But sometimes they have to just wait and see. The fact is, people don't all respond the same way to medications. A new field of research is trying to take out the guesswork and help doctors predict which medicines will be right for you.

Because each of us has a unique set of **genes**, we all have tiny differences in our bodies that can affect the way medicines do their jobs. While typical doses of medicines work well for most people, in others they might not work at all or could cause unwanted side effects. The study of how our genes affect the way we respond to medicines is called pharmacogenomics. The ultimate goal of this research is to tailor medicines to people's unique genetic make-ups, making drugs safer and more effective for everyone in the end.

For example, some people don't process certain cancer medicines as fast as others. A normal dose for most people could be a dangerous overdose for them. Dr. Howard L. McLeod's NIH-funded research group at Washington University in St. Louis

has found specific differences that can predict whether certain cancer drugs will be toxic to a patient. This knowledge can be used to design a test to help doctors know which patients shouldn't take these medicines.

"Patients will have more of a say in their therapy," McLeod explained at a recent scientific meeting. "It'll be their genes guiding decisions."

Anti-cancer drugs aren't the only ones that work differently depending

determines how people with chronic heart failure will respond to a beta blocker called bucindolol. In the future, tests may be able to tell doctors which patients this medicine will be able to help.

Pharmacogenomics is affecting many other fields of medicine as well. Researchers supported by NIH have found variations in genes that affect

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on our genes. Dr. Stephen Liggett at the University of Cincinnati Medical Center studies the effects of medicines called beta blockers in people with chronic heart failure.

"These medicines can be very effective in some people," he told the audience, "but the variability in response is enormous." Liggett's group, with funding from NIH, has pinpointed a single genetic difference that



Definition

Genes

Stretches of DNA, a substance you inherit from your parents, that define characteristics like height and eye color—and how you respond to medicines.

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Wise Choices

Make Your Own Personalized Medical Plan

Pharmacogenomics isn't the only way to practice personalized medicine. Start your own personalized medical plan now:

- **Gather your family's medical history** to find out what risks you might have inherited. (See the accompanying story in this issue for a free tool to help you gather this information). Then talk to your doctor about what you can do to lower these risks.
- **Start moving.** An active lifestyle can help ward off health problems. Walk, run, bike, swim, garden, or do any other physical activity you enjoy. Talk to your doctor about an exercise program that's right for you. NIH has many resources about exercise and physical fitness at health.nih.gov/result.asp/245.
- **Develop good eating habits and control your weight.** Good nutrition is a big part of staying healthy. NIH has resources to help at health.nih.gov/result.asp/474.
- **If you smoke, quit.** Smoking is the third leading cause of death in the U.S. For resources to help you quit, see health.nih.gov/result.asp/607.

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how people with asthma respond to a type of inhaled medicine. These genes might one day tell doctors which medicines will work best on a given patient. Researchers are also using pharmacogenomics to under-

stand why people react differently to medicines for mood and anxiety disorders. And the list doesn't end there.

So when might we see practical changes from these advances in our health care? "Health care systems will



Questions for Your Doctor

- How do I know if this medicine is working?
- What kinds of side effects should I be aware of when taking this medicine?
- What should I do if I get these side effects?

NIH News in Health

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Medicines for You:

www.nigms.nih.gov/medsforyou/index.html

The Promise of Pharmacogenomics:

www.ncbi.nlm.nih.gov/About/primer/pharm.html

gradually change," predicts Dr. Rochelle Long of NIH's National Institute of General Medical Sciences, who directs the Pharmacogenetics Research Network, a nationwide research effort sponsored by NIH to drive this new field forward. "Some changes are happening now, and within 5 to 10 years, medicine choices and doses will become much more tailored."

Tests to predict how patients will respond to some cancer medicines are already on the market. The Food and Drug Administration, NIH's sister agency, has also begun including pharmacogenomic information on some drug labels.

Ultimately, with the right privacy laws and security measures in place, we might all have cards in our wallets and doctors' offices containing our genetic information. Our doctors will use this information to predict which medicines will work best in our bodies. But Long cautions, "How to consider the sum total of all this research information is still a considerable challenge. That world is still some distance off in the future." ■



Statistics

Everyone's Different

- Nearly 3 million people in the U.S. are at risk for overdose when given the standard amount of a medicine used to prevent blood clots.
- Some people get no pain relief from certain prescription painkillers.
- Certain allergy and asthma medicines work well for some but not at all for others.

Source: National Institute of General Medical Sciences, NIH

History for Your Health

Collecting Family History to Prevent Disease

Many people collect their family history for a hobby. Did you know it might help save your life, too? Your doctor can use your family's health history to help figure out your risk of developing cancer, heart disease, asthma, diabetes, depression, and many other diseases and conditions. If you don't know your family's health history, now's the time to start collecting it. A free tool called "My Family Health Portrait" can help by organizing your important health information into a printout you can take to your doctor and put in your medical record.

"The bottom line is that knowing your family history can save your life," U.S. Surgeon General Dr. Richard H. Carmona explained in launching a campaign last year, called the Family History Initiative, to encourage all American families to learn more about their family health history. "Millions of dollars in medical research, equipment, and knowledge can't give us the information that this simple tool can."

That family history is important isn't new. Every young doctor learns that it's a valuable tool to help figure out which diseases to watch for in patients. Now that the human **genome** has been sequenced



www.hhs.gov/familyhistory/

as a result of the **Human Genome Project**, we can look forward to a future where we'll be able to identify glitches in our **genes** that can lead to illness. But it'll be years before we understand what all these genes do and how they interact with our environment to cause disease. Until then, tracking illnesses from one generation of a family to the next is a powerful tool for doctors. It can help them figure out what their patients are at risk for and guide them in creating personalized disease-prevention plans.

"Family history's not going to go out of style just because we've learned how to sequence the genome," Dr. Francis S. Collins, director of NIH's National Human Genome Research Institute, explained in a speech recently. "It's still going to be very valuable." NHGRI is one of many federal agencies involved in this project.



Questions for Your Doctor

What can I do to prevent the diseases that run in my family?

Gathering enough family history information to make useful predictions, however, isn't always easy.

Health care providers are often pressed for time and patients don't know the details of what diseases run in their families. "My Family Health Portrait" can help you gather and record important health information before your medical appointments.

"My Family Health Portrait" is available in both electronic and print versions, in

English and Spanish. If you use the electronic version, all personal information you enter is kept on the computer you're using; none is available to the federal government or any other agency. After you enter details about your grandparents, parents, siblings, children, aunts, uncles, and cousins, the program will print a diagram that your health provider can use to design personalized diagnosis, treatment, and prevention plans.

You can download "My Family Health Portrait" from the Department of Health & Human Services web site at www.hhs.gov/familyhistory. If you don't have a computer, call 1-888-Ask-HRSA (275-4772) and ask for "My Family Health Portrait" in English (ask for HRS00360) or Spanish (HRS00361). ■



Definitions

Genes

(See page 1 for definition.)

Genome

Full set of genes (in a person or any other living thing).

Human Genome Project

An international research effort to decipher the order, or "sequence," of DNA in all the genes we carry. Read more at <http://www.genome.gov/12011238>.



Statistics

Americans who believe knowing their family's health history is important to their health: 96.3%

Americans who have ever tried to gather and organize their family's health history: 29.8 %

Source: U.S. Centers for Disease Control and Prevention

Health Capsules

Possible Treatment Changes for Asthma

Some adults with mild persistent asthma may be able to control their asthma by taking **corticosteroids** only when needed, according to a new study supported by NIH. Those who took corticosteroids when their symptoms arose had about the same number of severe asthma flare-ups as those taking daily, long-term control medications. This finding needs to be confirmed in a larger study, but it suggests that some patients may be able to safely avoid the expense and inconvenience of daily medication.

More than 20 million Americans have asthma. Mild persistent asthma brings symptoms like wheezing, coughing, or chest tightness more than twice a week but not daily, or wakes you up more than two nights a month. National treatment guidelines recommend daily long-term control medication to prevent symp-

toms, along with quick-relief medication (inhaled **bronchodilator**) as needed to treat acute symptoms.

For this study, the researchers put 255 adult patients into three treatment groups. Two groups took asthma control medication twice a day—either an inhaled corticosteroid or another type of asthma medication in pill form. The third received a placebo (inactive) medication. All were given additional medicines with clear instructions on how to use them to treat symptoms if they appeared.

After one year, the three groups were similar in measurements of lung

air flow, the number of severe asthma attacks, and quality-of-life tests. Those in the daily inhaled steroid group, however, did have significantly more symptom-free days than those in the other two treatment groups.

An expert panel will soon consider whether to change treatment recommendations for adults with mild persistent asthma. For those with more frequent symptoms or more severe asthma, these new findings don't apply. If you have asthma, however severe, work with your health care provider to develop and follow an asthma treatment plan. ■



Asthma: www.nhlbi.nih.gov/health/dci/Diseases/Asthma/Asthma_WhatIs.html

Focus on Asthma: www2.niaid.nih.gov/newsroom/focuson/asthma01/default.htm



Definitions

Bronchodilator

Inhaled medicine used to relieve symptoms during an asthma attack.

Corticosteroid

Medicine used to help prevent symptoms of asthma. Some are inhaled, some are taken orally.

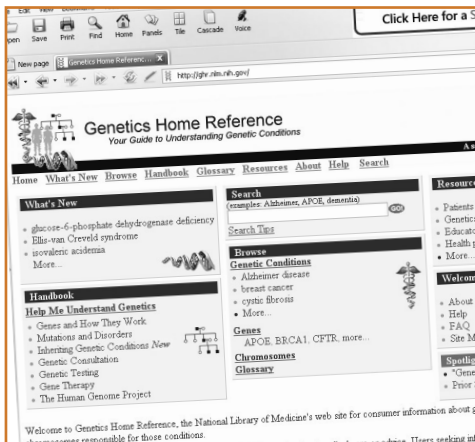


Featured Web Site

Genetics Home Reference

<http://ghr.nlm.nih.gov>

Your guide to understanding genetic conditions. Find out how genes work and how changes in certain genes can cause disease. You can also learn about genetic testing, gene therapy, and the Human Genome Project. From NIH's National Library of Medicine.



Red Hair Blues

Some doctors have claimed that people with naturally red hair may need more **anesthetic** than others. It turns out they may be right.

Dr. Daniel Sessler of the University of Louisville School of Medicine decided it was time to put the issue to the test. His research group, with funds from NIH, recruited 10 women with naturally bright red hair and an equal number with black or dark brown hair.

Researchers gave the women an inhaled anesthetic, then applied a harmless shock to each woman's thigh and watched for movement. They adjusted each woman's dose until she had a reflex movement half the time, a standard method for finding the right dose of an anesthetic. Nearly all of the red-haired women needed 20 percent more anesthetic than those with dark hair.

Just about all people with red hair share a common genetic variation that affects hair and skin color. After analyzing DNA from the women, the researchers identified this variation in 90 percent of the red-haired women who needed more anesthetic.

While these findings don't directly link hair color genes to anesthetic response, they do suggest that health care providers should monitor anesthetic doses carefully in redheads. The research also opens the door to further study into the genetics of anesthetic response. ■



Definition

Anesthetic

Pain-killing medicine that causes a loss of sensation and sometimes loss of consciousness while preserving vital functions like breathing during medical procedures or surgery.